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Seasonal fluctuation and the management tactics of guava whitefly, *Aleurodicus dispersus*

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ABSTRACT

An Aleurodicus dispersus has become one of the most serious pests of guava in Bangladesh. The study on seasonal abundance in different months indicated that the maximum whitefly population occurred during March 2016 to November 2017. Comparison the effectiveness of application of water, detergent and smoke, it was found that spraying of detergent on the twigs reduced the number of whiteflies significantly. Study of chemical control on whitefly to reduce the population at different stages revealed that Diazinon at the dose of 0.18% reduced the whitefly population (> 90%) significantly after 3, 7, 15 and 30 days of spraying which is similar with the dose of 0.18%. a.i. of Malathion 57EC which caused a good reduction of whitefly adults and nymphs for several days of time interval. Both insecticides were effective and persistent when applied at higher dose to A. dispersus. Therefore, among the treatments the spray at 0.18% concentration of Malathion and Diazinon was the best in controlling the whitefly.

Key Words: *Guava, White fly, Control, Malthion and Diazinon*

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I. Introduction

Guava, *Psidium guajava* (Family: Myrtaceae) is really an important addition to popular fruits in Bangladesh, that supplies a subsequent portion of vitamin C (Lubis *et al.* 2017). It is accepted as the apple of the tropics. There are 46 identified species of whitefly which cause economic injury to the economic plants around the world (Martin 1987; Ramani *et al.* 2002). Recently, it has been reported that 4 species of whitefly-*Aleurocanthus rugosa* Singh, *A. woglumi* Ashby, *Aleuroputeus perseae* Corbett and *Alerotuberculatus psidii* (Singh) were identified from guava in Bangladesh (Kajita and Alam, 1996). In recent years, another species of spiraling whitefly *Aleurodicus dispersus* Russel has become a serious problem to guava cultivation (Ramani *et al.* 2002) in Bangladesh, causing of huge loss to the actual vegetation as well as fruits. *A. dispersus* was detected in Hawaii in the late 1970s and is suspected that

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this pest species has been introduced in Bangladesh through immigration and the importation of unchecked plant materials from other countries (Scanlan 1995). This pest causes direct and indirect damage to the plant (Arifunnahar *et al.* 2018). They suck cell sap from the leaf causing the reduction associated with growth vigor of the plant and decline of yield. Indirectly the whitefly leads to decrease of yield by transmitting viral pathogens and through secretion of wax and honeydew which reduces the photosynthetic area of the plant (Alam *et al.* 1998).

Whitefly is certainly problematic to control since their particular nymphal stages continue to be beneath the waxy masking. In Bangladesh, using insecticide could be the typical exercise with regards to manage this notorious pest which is associated with insect resistance, environment contamination, raised wellness threat towards applicators, a hazard to the customers with regard to toxic residuals available on the market products, etc. The present study was undertaken to determine the seasonal abundance and the effective control methods of this pest. The effective control measures may impact to slow down the uses of pesticides and therefore, support to integrated pest management on a sustainable basis.

II. Materials and Methods

The experiment was conducted in the Pot house of the Department of Crop Botany of Bangladesh Levels of whitefly infestation in different months were studied on the variety *'Kazipiara'*. Notably infested plants were selected and four twigs of different sides (east, west, north and south) were chosen randomly from each plant. The total number of nymphs and adults of whitefly were recorded per twig.

Control of whitefly using water, detergent and smoke

There were three treatments including water as a control, detergent and smoke were used to investigate as non-insecticide or mechanical approaches. Detergent was applied by mixing with water to suppress whitefly populations. The foot paddle sprayer was used for spraying of water and the detergent. The concentration of the detergent was 2.5 g/L. Smoke acts as a physical repellent of insect. Here smoke of *'Dhup'* was used to control whitefly. The number of nymphs and adults per twig having around 10 leaves were recorded after 1 hr, 1, 5 and 10 days of application of water, detergent and smoke.

Effectiveness of two selected insecticides in controlling whitefly

Two insecticides *viz*. Diazinon 60EC and Malathion 57EC were sprayed with the aim of controlling the whitefly. Each insecticide was tested with three different doses and efficacy of the doses on whitefly was compared. The doses of 0.06, 0.12 and 0.18% were applied with the help of a hand-operated sprayer. Before each application, the sprayer was calibrated without insecticides in order to use the right dose on the plants by determining the quantity of water required for each plant. The control plants were sprayed only with water. The number of nymphs and adults per infested twig having around 10 leaves were recorded randomly after 1, 3, 7, 15 and 30 days of spraying of insecticides.

The experiment was designed in a Randomized Complete Block Design (RCBD) in the standing guava orchard. Treatments were replicated 4 times for water, detergent, smoke and replicated 5 times for insecticides. Here, a plant was considered as one replication. Assessment of reduction of whitefly due to use of water, detergent, smoke and insecticides were observed and analyzed using two ways ANOVA. Guava plants range between 5 to 6 years old were selected for the experiment at the commercial guava orchard of a selected farmer at Kalihati Sadar Upazilla, Tangail for the period from March 2016 to November 2017.

III. Results and Discussion

Seasonal fluctuation of whitefly

The number of whitefly populations (nymphs and adults) were varied (Figure 01) in one year study period. The peak period of whitefly infestation was found in January to March agreed by Rashid *et al.* (2003). In the month of August, adult whiteflies started to lay eggs on the bottom of top young leaves when the whitefly populations per twig were significantly least amount. Following April whitefly population decreased to zero with the month of May to July. Temperature, rainfall, humidity, and even sunshine may have tremendous exaggeration on the populations in whitefly. Sathe (2015) reported that the intensity of whitefly was high from January to June and whitefly abundance increased rapidly from July to September in cotton (Blua *et al.* 1994). Beginning in August and September, whitefly densities increased in melon. Salinas and Sumalde (1994) reported that high temperature and rainfall appeared to have a tremendous effect on the population of the wooly whitefly. Temperature, relative humidity and the number of rainy days had a highly significant correlation with the adult population of whitefly (Saline, 1994). There was a significant ($p<0.01$) correlation appeared between rainfall and population density of whitefly and between temperature and population density of whitefly. A negative correlation ($r = - 0.826$) was found between rainfall and adult whitefly which indicated that increase of rainfall is really a decreasing factor of population density of whitefly. Similar correlation was found between rainfall and nymphs ($r = - 0.800$), temperature and adult ($r = - 0.833$), and temperature and nymph ($r = - 0.858$). Marabi *et al.* (2017) reported that whitefly population showed significantly negative correlation with temperature, relative humidity and rainfall in Rabi season. It was visible that the adult whitefly and their nymph were substantial amount in cold and dry months. The environmental disorders in the summer in addition to monsoon were not advantageous with regard to survival as well as multiplication of spiraling whitefly that explains the negative effect of rainfall and temperatures.

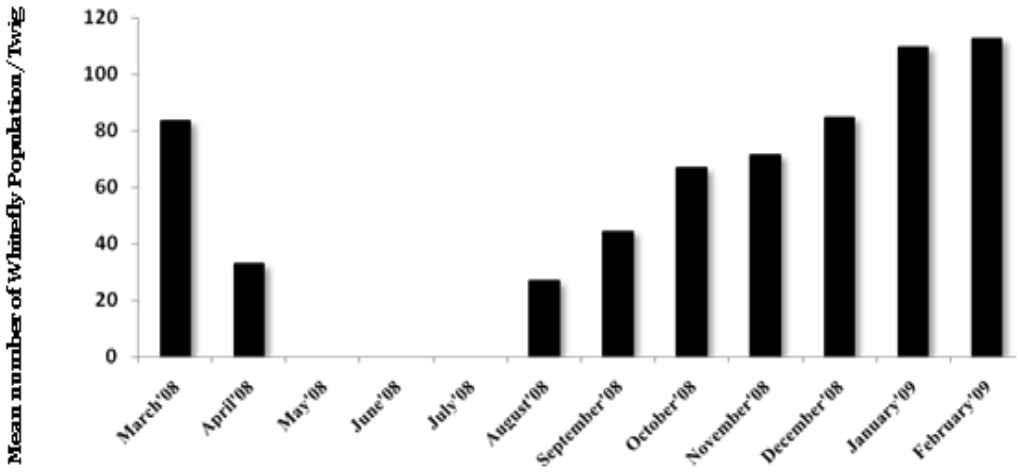

Figure 01. Level of infestation of *Aleurodicus dispersus* (Adult and Nymph) attacking Guava in Different months

Mechanical control of whitefly

Application of water, detergent, and smoke were evaluated against the pest *Aleurodicus dispersus*. It was found that significant differences were found in survival of both nymph and adult with the application of water, detergent, and smoke at different time intervals. It was evident that detergent was more effective to control adult than the nymph. A significant reduction of adult whiteflies density was very close to 10 days after application with that of 1hr by the application of detergent (Table 01). Less number of adult and nymph were recorded in the first 1hr by the smoke application, but efficacy was no longer remained due to smoke ingredients may mixed up in the air. Mean survival percentage of adult and nymph whiteflies per twig were significantly higher at after 10 days in case of the smoke application while the survival percentage was a minimum at after 1 day through detergent sprayed on twigs were statistically similar with others observation times.

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Table 01. Survival of whitefly after application of water, detergent and smoke

Treatment	Adult (Mean number of survivals per twig at different observation periods)				Nymph			
	1 hr	1 day	5 days	10 days	1 hr	1 day	5 days	10 days
Water	2.36±0.20a (73.69)	1.04±0.16b (88.41)	1.24±0.32b (86.18)	3.44±0.26b (61.65)	7.32±0.67a (64.65)	5.60±0.69b (80.61)	5.16±0.79b (79.36)	7.44±0.43b (74.24)
Detergent	1.84±0.20b (79.49)	0.72±0.16b (91.79)	0.96±0.32b (89.30)	1.88±0.26c (79.04)	6.96±0.67b (75.90)	5.16±0.69b (82.13)	5.16±0.79b (82.13)	6.60±0.43b (77.15)
Smoke	0.68±0.20c (92.42)	1.80±0.16a (79.93)	2.52±0.32a (71.91)	6.20±0.26a (30.88)	9.36±0.67b (67.59)	10.4±0.69a (63.85)	11.5±0.79a (60.25)	16.0±0.43a (44.60)

In a column figures having common letter(s) do not differ significantly at 1% level (df=2), values of the parenthesis indicate percent reduction of whitefly.

Banjo *et al*. (2004) concluded that intensive spraying of the underside of leaves with water and detergent will only reduce the populations of *Aleurodicus dispersus*. However, Geetha (2000) found that detergent soap solution (5%) was highly effective to control nymph and adult of whitefly.

Performance of insecticides on whitefly population

The effect of two selected insecticides namely Diazinon 60EC and Malathion 57EC with three different doses were evaluated on the spiralling whitefly, *A. dispersus* population at 24 hrs, 3 days, 7 days, 15 days and 30 days after spraying. Mortality of adult of *A. dispersus* may varied through applications of Diazinon 60EC and Malathion 57EC at different doses at different observation periods (Table 02). A strong significant difference was found in between the effectiveness of Diazinon and Malathion, where Malathion was more effective to control of adult whitefly. Significant variations were found within the doses of insecticides to control of adult whitefly. Doses of 0.12 and 0.18% a.i. of Malathion were completely reduced adults close to 15 days rather than Diazion. Data showed that both insecticides with 0.18% a.i. had better performance to control adult at all observation periods.

Table 02. Survival of adult whitefly after spraying of Diazinon 60 EC and Malathion 57 EC

Insecticide	Dose (% a.i.)	Adult (Mean number survive per twig at different observation periods)				
		24 hours	3 days	7 days	15 days	30 days
Diazinon 60EC	0.06	2.64±0.14a (69.86)	1.84±0.16a (78.99)	1.00±0.18a (88.58)	1.44±0.12a (83.56)	2.84±0.17a (67.58)
	0.12	2.32±0.14a (73.52)	1.28±0.16b (85.39)	0.78±0.18ab (92.01)	1.12±0.12a (87.21)	2.64±0.17a (69.86)
	0.18	1.56±0.14b (82.19)	0.56±0.16c (93.61)	0.48±0.18b (94.52)	0.52±0.12a (94.06)	0.80±0.17b (90.87)
Malathion 57EC	0.06	1.20±0.11a (86.30)	0.64±0.06a (92.69)	0.08±0.04 (99.09)	0.04±0.03 (99.54)	1.92±0.09a (78.08)
	0.12	0.00±0.11b (100.00)	0.00±0.06b (100.00)	0.00±0.04 (100.00)	0.00±0.03 (100.00)	1.36±0.09b (84.47)
	0.18	0.00±0.11b (100.00)	0.00±0.04b (100.00)	0.00±0.03 (100.00)	0.00±0.03 (100.00)	1.16±0.09b (86.76)

In a column figures having common letter(s) do not differ significantly at 1% level (df=2), values of the parenthesis indicate percent reduction of whitefly

The mean number of nymphs survived was significantly higher in case dose of 0.06% while the lowest nymph survival was found in 0.18% a.i. of Diazinon 60EC (Table 03). Survival data of nymph after spraying of Malathion 57EC showed that there were significant differences in the effect of three doses. Lower survive of adults was found with 0.12% a.i. and 0.18% a.i. of Malathion. But, the numbers of nymph survived were varied in three doses, where lowest number of nymphs survived @ 0.18% a.i. at different observation periods. It is concluded that adults were more susceptible to the insecticides rather than nymph supported by Rashid *et al*. (2003). Lowest mortality in the nymphal stage of whitefly might be for the presence of wax filaments on the body. The wax layer could have reduced the effectiveness of insecticides against the pest. The present evaluation of the effectiveness of 3 different doses of Diazinon 60EC and Malathion 57EC on whitefly remained up to two weeks of spraying suggests that dose 0.18% a.i. could be more effective to be used against the pest whitefly for rapid control.

Sales *et al.* (1983) reported that 94% mortality of whitefly, *A. cocois* (Court) was obtained with Mevinphos after the adults were confirmed for 20hrs on treated filter paper in petridishes. Singh *et al.* (1992) reported that the synthetic pyrethroids significantly reduced the population of the whiteflies and remained effective up to 8th days of spraying. The application of insecticides in orchard condition should follow interval period between two applications should not be less than 15 days for safe value of fruits.

Table 03. Survival of nymph of whitefly after spraying of Diazinon 60 EC and Malathion 57 EC

Insecticides	Dose (% a.i.)	Nymph (Mean number survive per twig at different observation periods)				
		24 hours	3 days	7 days	15 days	30 days
Diazinon 60EC	0.06	8.40±0.44a (68.89)	7.20±0.40a (73.33)	6.16±0.36a (77.19)	7.08±0.38a (73.78)	8.84±0.43a (67.26)
	0.12	7.84±0.44ab (70.96)	5.08±0.40b (81.19)	4.88±0.36b (81.93)	6.12±0.38a (77.33)	8.08±0.43a (70.07)
	0.18	6.80±0.44b (74.81)	5.56±0.40b (79.40)	5.20±0.36b (80.74)	5.08±0.38b (81.19)	5.60±0.43b (79.26)
Malathion 57EC	0.06	9.28±0.44a (67.38)	5.56±0.30a (80.46)	4.30±0.14a (84.82)	4.84±0.13a (82.99)	7.96±0.31a (72.02)
	0.12	8.56±0.44a (69.91)	4.08±0.30b (45.66)	3.28±0.14b (88.47)	2.08±0.13b (92.69)	6.96±0.31b (75.54)
	0.18	7.40±0.44b (73.99)	3.48±0.30b (87.77)	2.72±0.14c (90.44)	1.48±0.13c (94.80)	6.62±0.31b (76.73)

In a column figures having common letter(s) do not differ significantly at 1% level (df=2), values of the parenthesis indicate percent reduction of whitefly.

V. Conclusion

The nymphs and adults of spiralling whitefly, *A. dispersus* cause considerable damage of guava plants. The study on seasonal abundance in different months indicated that the maximum whitefly population occurred during the month of January to March. Comparing the effectiveness of application of water, detergent and smoke, it was found that spraying of detergent on the twigs reduced the number of whiteflies significantly than other treatments. The application of the insecticides Diazinon 60EC and Malathion 57EC against *A. dispersus* resulted in a significant reduction of the pest in guava. Diazinon at the dose of 0.18% reduced the whitefly population (> 90%) significantly after 3, 7, 15 and 30 days of spraying which is similar with the dose of 0.18% a.i. of Malathion 57EC that caused a good reduction of whitefly adults and nymphs for several days of time interval. Both insecticides were effective when applied at higher dose and had a good persistent effect for the pest *A. dispersus.* Therefore, 0.18% concentration of Malathion and Diazinon could be sprayed against whitefly.

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